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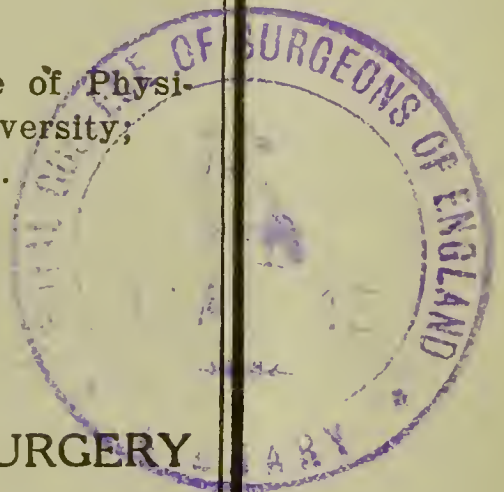
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# FEMUR FRACTURES: STATISTICS OF END-RESULTS.\*

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The educational value of fracture statistics to our profession, to the Workmen's Compensation insurance companies, and to the public is just being taught, and when fully understood and appreciated, it will very materially improve the efficiency of our treatment of fractures.

Wherever one studies the statistics of accidents it is universally found that collapse of structure and falls of materials cause the larger number of accidents, and the results of these accidents are wounds and fractures. The relative severity of these injuries is best illustrated by the consideration of the time lost as a result of them, and the highest average loss shown by any of the injuries is due to fractures.

To illustrate with a specific example from the 1913 Annual Report of the Industrial Insurance Department of the State of Washington: 12,380 cases of accidents received \$465,000 compensation for 340,000 days of disability. Among these were 1,383 cases of fractures which received \$122,000 for 90,000 days of disability; that is, the fractures, which constituted only 10 per cent. of the total injuries, received 27 per cent. of the total compensation. Furthermore, 266 cases, or 20 per cent., of all fractures still suffered some permanent partial disability. Similar conditions could be

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shown wherever accurate detailed records have been tabulated, but in this country, up to the present time, there are scarcely any similar statistics. However, experts for the Workmen's Compensation commissions will secure such statistics during the coming years. When these facts become sufficiently widely known and understood, employers of labor who must actually pay the costs of compensation, will demand that the present length of disability be diminished. This has become a question of economics and we must thoroughly appreciate that compensation laws will demand the same increased efficiency from our methods of treatment as is being secured in all other branches of industry.

Many surgeons feel that numbers of the "bad set" fractures which become useful only after twelve to eighteen months might be just as good after four to six months, if more efficiently treated. During the last two years, as our profession has been more carefully investigating the end-results after fracture, surgeons have become *convinced* that the *results must be improved*. The public, since the advent of *x*-rays, has become better educated and are demanding shorter and more efficient treatment, a briefer period of disability with better functional results.

Up to the last three years the general profession believed that fractures were being treated satisfactorily. This was due to the fact that the surgeons did not follow up their patients to the end, and therefore were ignorant of the final results. A few surgeons who kept patients under careful observation for longer periods became convinced that the average results were very unsatisfactory. They believed these bad results were due to inefficient treatment, but their conclusions are not generally

accepted and will not be approved until demonstrated by a large mass of reliable statistics collected from various sources. The wide experience of many surgeons must thus be brought together in an authoritative form, and subjected to critical analysis to disclose all the results under past and present methods.

It therefore becomes most necessary to establish authoritative standards by which subsequent fracture work can be measured and compared. Only in this way can the average duration of disability be determined. This will become of great value both for the instruction of lawyers and courts and for the protection of the surgeons.

The Fracture Committee of the American Surgical Association earnestly desires every surgeon to report before May, 1915, all fractures of the lower extremities in which the final *result is definitely known*.

Every surgeon knows when discussing present standards that wide discrepancies are glaringly apparent. If one would learn about fractures he should not read books, but visit the law courts and listen to an unfortunate doctor explaining what a "satisfactory result" is. This too elastic phrase has become obsolete, for it did not conform to any uniform standard.

Fracture of the femur occurs in about ten per cent. of all fractures and offers by far the greatest difficulties in its treatment. As its injury most seriously incapacitates the workman, it is of unusual importance to investigate the end-results of the present methods of treatment and to suggest how these may be improved.

The following authorities present the statistics.



of end-results which are at present most available for study:

1. Von Bergmann reports 121 cases in which 39, or 32 per cent., fully recovered, the average period of disability being 54 weeks.

2. The British Fracture Committee reports 727 cases, of which 298 were over 15 years of age. Of 87 fractures of the neck, 20, or 23 per cent., recovered good function; of 49 fractures of the upper third, 23, or 47 per cent., recovered good function; of 108 fractures of the middle third, 53, or 49 per cent., recovered good function; of 54 fractures of the lower third, 30, or 55 per cent., recovered good function.

The 126 cases including all groups averaged only 42 per cent. of good function.

In 179 cases the average period of disability was 33.6 weeks. In 21 cases, or 11 per cent., the disability was permanent.

3. Scudder reported 35 cases, of which 16 were adults (between 18 and 48 years of age). Of these, only 5, or 31 per cent., were perfect. The working capacity of the remaining 11 was depreciated by limited knee-joint movements, pain after working, lameness in walking, weakness in the whole leg, and lack of endurance.

4. Hitzrot reported 20 adults between 15 and 76 years of age. Of 16 cases treated by non-operative methods, 15 recovered perfect function within 52 weeks. In 4 cases where the overriding could not be reduced, operation was performed and good function was secured within 52 weeks.

5. Ashhurst traces 21 cases out of 58 treated in the Episcopal Hospital, Philadelphia. Five recovered perfect function, 8 others were able to work but still limped, so he concluded 13, or 62 per cent.,

secured useful limbs. However, of these 21 cases, 11 were under 16 years of age.

6. Faltin, after studying the compensation awards made by the insurance companies in Sweden, reported the average period of temporary disability at seven months and that partial disability continued for three to four months longer.

The above statistics have been collected from surgical literature and we already see that the widest variations and obvious inaccuracies exist. Thus far, the different states have not yet classified their statistics sufficiently to give the data of different fractures, such as femur, tibia, etc. In 1912, Minnesota published its 13th Report of the Bureau of Labor. In 1,230 of the various fractures recorded during 1910, 1911, and 1912, under the compensation law, 467 were classified as fractures of the hip, thigh, knee, and ankle. No statement was made regarding the percentage of good results. In only 516 out of the 1,230 cases was the length of disability recorded, but it was stated that in *only* 13 cases was it more than 24 weeks and *no* case exceeded 36 weeks.

The above-mentioned Washington insurance report states that of 67 cases of fracture of femur, 53 of which were treated without operation averaged 158½ days of disability and 14 cases treated by operative methods averaged 209 days.

Unsatisfactory and disappointing as these statistics are, how very startling are the following which have been followed up most scientifically by the Austrian government in obedience to the requirements of the insurance societies in 1911. These records are of the greatest value and tell a different and sadder story than that of our incomplete and inaccurate professional records. There were

857 fractures of the femur, of which 153, or 17.8 per cent., recovered with only temporary disability, but the length of this disability is not stated; 683, or 79.7 per cent., suffered some permanent disability; 99 had a loss of 9 to 19 per cent. of their earning power; 120 a loss of 19 to 32 per cent.; 134 a loss of 33 to 48 per cent.; 330 a loss of over 50 per cent.; 38 per cent. of all cases suffered a loss of 50 per cent. earning power.

It is now very evident that it is impossible from all these confusing statements to determine an accurate standard for the duration of disability. We must first accurately record and follow up to the end our own cases to learn the results of our own methods. The more carefully fracture patients are followed up, the more astonished we are to learn how many men are permanently more or less disabled and how rarely ideal functional results are secured. All general hospital records are notoriously inadequate, for the end-results are seldom stated. Patients are discharged as cured when they leave the hospital at the end of eight to ten weeks, although they go away on crutches. True, the bone has united, but normal function has not been restored—the patient has not yet regained his earning power.

It is gross ignorance of the whole problem of industrial accidents to confuse the surgical and economic results of an injury. From the point of view of an editor, a fractured collar-bone is a minor accident, though it may interfere with a successful game of golf. But to a manual laborer, the collar-bone is the mainstay of his working mechanism upon which a good deal of strain falls, and long after surgical union has taken place, the mechanism remains weak and defective. Among 742 fractures



of the collar-bone in Austrian workmen, occurring in five years, 1897-1901, 372, or just 50 per cent., resulted in permanent partial disability, and of these 60 were impaired up to one-half or more of their previous earning capacity.

Hereafter, under the compensation law, it will be necessary to determine the length of the period which elapses between the accident and the date on which the patient is able to resume his customary normal work, and our profession must recognize this as the approximate period required to regain normal function.

The purpose of this paper is to impress upon our profession the urgent necessity of very materially shortening the present period of duration of disability.

Compensation will demand improved standards. The end of the present régime is rapidly arriving, for the radiogram has forced surgeons to appreciate keenly how bad the results are when treated by the average methods.

Wherein lies the inefficiency of these methods?

Recently, in gathering statistics for the Fracture Committee of the American Surgical Association, I tabulated the histories of 340 fractured femurs collected from several different hospitals.

The records indicated that traction was but rarely applied under 12 hours, and, in less than 5 per cent., under 24 hours; furthermore, when applied, the weight was generally insufficient, the amounts being frequently stated as 10, 12, or 15 pounds. When Buck's extension was used, the foot of the bed was occasionally raised, but *seldom* was direct perineal *counter-extension* employed. Reduction under anesthesia is not stated to have been employed in more

than 16 per cent. Radiograms showed overlapping and angulation in the largest number of cases.

In this connection it is interesting to note the replies received three years ago from 92 surgeons in Canada and the United States. Sixty-nine thought that 1 inch of shortening was permissible after the fracture of the femur; 19 thought that not more than  $\frac{3}{4}$  inch, and only 4 thought that not more than  $\frac{1}{2}$  inch could be permitted. To-day many of the first group have changed their opinions and agree with the last group.

Many of these bad results are avoidable, as they have been due to neglect and lack of efficient treatment, for the patients have been left to the care of junior house officers.

The demand for general operative cases has crowded fracture cases out from the hospital wards. A plaster of paris cast has been applied and the patient has been discharged or transferred to another hospital. At one period, 50 per cent. of the fractured patients admitted to Bellevue Hospital had been transferred from other hospitals.

Great improvement, even 25 per cent., will surely follow if treatment truly intelligent, prompt, and efficient be employed, the most important factor being that it must be efficient *from the very first* and there must be NO delay.

(1) *Reduction* must be thorough, and in the larger number of patients *anesthesia* will be required.

If seen early enough, end-to-end apposition should be secured in many of the transverse and oblique fractures. Formerly it was supposed that spiral fractures of the femur were the most frequent, but analysis of the radiograms of 100 femurs showed 32 spiral, 50 oblique, and 18 transverse.

In this connection I would say that manufacturers are developing a fluoroscopic apparatus which, when perfected, will enable one with a suitable extension apparatus to accurately reduce many of the oblique and transverse fractures.

(2) *Traction.* Immediately after reduction a sufficient amount of traction must be applied and maintained long enough to secure correct fixation of fragments. Generally it is too small and frequently it becomes intermittent and irregular, so that often angulation occurs, even after the first radiogram has shown the fragments in good alignment. The muscles subsequently contract and produce too much movement of the fragment with overriding and shortening.

Traction, to be efficient, must be powerful enough and the force must be applied in the right normal direction to overcome the pull of all the opposing muscles. Shortening is thus obliterated and correct alignment is secured.

The ideal results obtained by Bardenheuer were due to his thorough application of this most important principle in all his practice.

In fractures of the femur, especially of the shaft, traction that maintains correct alignment will also at the same time secure good anatomical position. This corroborates the findings of the British Fracture Committee—that where the anatomical result is good, then the functional result is good in 90.7 per cent.; but that when the anatomical result is moderate or bad, then a good functional result occurs in only 29.7 per cent. It is therefore of the highest importance that the surgeon secure anatomical reduction.

Bad results are nearly always associated with angulation and are largely due to that cause. This

is conclusively demonstrated by the study of any large series of radiograms. Angulation results from ineffectual traction.

In children, traction is much more easily applied and far better maintained; the muscles are less resistant, the weights smaller; the child is lighter and smaller and more easily lifted into correct position by one nurse or attendant house officer, consequently normal alignment is more often maintained. These facts largely explain why the results are far better in children than in adults where traction is far more difficult to maintain.

Under 15 years of age, in 1,016 cases, good functional results were obtained in 90.8 per cent.

Over 15 years of age, in 1,580 cases, good functional results were obtained in only 45.4 per cent.

(3) *Radiograms* must be systematically employed in all cases of fracture of the femur to control the results of reduction. While some may be misleading, yet when made by a qualified operator, they furnish the best records of the relative position of the fragments and they give invaluable assistance in showing how unsatisfactory results may be improved.

Hereafter, in seeking compensation, the patient will surely secure a radiogram, so it is therefore advisable for the surgeon to have previously fortified himself. Courts have generally decided to accept radiograms as evidence. I therefore thoroughly agree with Estes that no physician should undertake the care of a fractured femur unless he can have the benefit of the assistance of a radiogram.

In this connection I believe the time will come when metropolitan hospitals will become so organized that fractures will be assigned to especially



equipped wards under the care of surgeons who are particularly interested in the treatment of fractures.

Further, I believe it would be most advisable, both for the future welfare of the patient and also for the economy of employers, that they should require that all fracture cases be sent to hospitals having x-ray equipments and extension apparatus and where skilled surgeons should treat them, rather than the company surgeons in their own homes.

(4) *Consolidation.* This period is subject to considerable variation, for the academic period stated in text-books cannot be depended upon, as experience proves that quite a percentage require additional time for complete consolidation.

It therefore happens that when the body weight is carried too early on the recovering femur, bending begins, and if continued, marked angulation and deformity occur.

Again, it is in just these cases that the radiogram is of so great assistance, for it comes to help us before it is too late.

(5) *Operation.* Recently sufficient evidence has been presented to definitely recommend operations by skilled hands for fractures of the femur in the cases where reduction is inadequate. Adequate reduction requires that the ends remain in apposition without obvious angulation or axial rotation, and that the shortening be not greater than  $\frac{1}{2}$  inch.

Many surgeons who have had special experience in the treatment of fractures have learned to consider that certain kinds of fractures presenting characteristic radiographic evidence are best treated by operation. In these selected cases after the clinical

diagnosis has been confirmed by a radiogram, then the decision is made to operate at once, for here, as elsewhere, operative methods to be successful must be efficient from the first.

“If a surgeon is doubtful whether he can treat a fracture efficiently by a non-operative method, he ought to consider whether he cannot do better by operating at once. He ought not to say, ‘We can see what becomes of it and if it is not satisfactory we can operate later,’ for by so doing the opportunity of getting a good functional result may be irretrievably lost.”

The British Fracture Committee reported that when operation was too long delayed the prospects for good results were sacrificed.

In 147 cases in which primary operation was decided upon, good function was secured in 80 per cent. In 78 cases in which operation was resorted to only secondarily after failure of other treatment, good function was secured in only 60 per cent. In 83 cases in which operation was performed still later on account of malunion, good function followed in only 38 per cent.

The above statistics are corroborated by a series of 37 cases of fracture of the femur collected by the writer.

In 10 cases of primary operation, good function resulted in 80 per cent.; whereas in 27 cases of secondary operation, good function was secured in only 60 per cent. However, the average of good functional results obtained by these operations was 65 per cent.; much in contrast with the 42 per cent. obtained by non-operative methods in the cases collected by the British Fracture Committee.

As both the American and English series of im-

mediate operation were followed by good functional results in 80 per cent. of the cases, it is quite evident that the present results can certainly be improved from 35 per cent. to 50 per cent.

That delay in operating is very general, even among our own surgeons, is indicated from the fact that among 388 cases of operations collected from members of the American Surgical Association, only 78 cases, or 20 per cent., were operated upon immediately; 310 operations were performed only after other methods had failed.

Of these 388 cases of operations, 143, or 37 per cent., were for fractures of the femur. It is therefore certain that surgeons are favoring more and more operations for fractures of the femur. Results warrant the belief that operations are indicated upon the femur in fractures of the upper and lower thirds when the fragments are much displaced, as they frequently are, and in spiral fractures of the shaft, for it is just this class of cases which uniformly give the poorest results following non-operative treatment.

Finally, in the treatment of fractures of the femur many surgeons are now experiencing similarly unsatisfactory results, as they did fifteen years ago, when they postponed the time for operation in acute appendicitis and in gastric and duodenal ulcers with perforation. The same brilliant results that followed immediate operation in the above cases will likewise follow prompt operation in selected cases of fracture of the femur.

The number of operations will surely increase, but the larger number of fractures will be treated without operation, and the lesson to be constantly taught is *efficiency, efficiency in every detail from the hour of the accident.*

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